TECHNOLOGY DEVELOPMENT POLICY IN BULGARIA

CENTER FOR ECONOMIC DEVELOPMENT

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Introduction

The rapid development of technologies requires new standards of management decision taking at all levels of economy - micro, meso, and macro. Technology development decisions taken at the micro-level of economy are dictated by companies' desire to be more competitive through more efficient utilization of limited resources and by putting out unique quality products. Such decisions are to a great extent dependent on the macroeconomic environment.

Macro-level decisions are considerably more complex because of the efforts to strike a balance between the *laisser-faire* approach of governmental non-interference in free-market mechanisms and the need to create an environment conducive to sustainable economic growth based on higher competitiveness of individual market players. Striking such balance is a must prerequisite for the congruous development of a country's economy. Going to extremes is in any case counterproductive to the normal development of business and economy. Practices worldwide have indicated that there is no country with a well-developed economy that will not pursue a purposeful policy to develop technologies, inclusive of measures akin to subsidies, priority setting, and fiscal concessions.

The need to implement governmental policy with regard to research, innovation, and technology development is explained by the so called „market failures"[1]:

- The rate of return of investment in research and development is much higher for the society as a whole than for the company reaping the benefits from such investment.
- There exists too high a risk inherent in research and development that can hardly be covered by the company benefiting from the product since it is spread over small quantities. This „market failure" is particularly valid for small and medium sized enterprises,

1 Dominique Guellec and Bruno van Potterlberghe de la Potterie, *Does Government Support Stimulate Private Sector?*, OECD Economics Studies No 2, 1997/II, p. 96

which cannot afford diversification of the risk stemming from the introduction of innovations.

The larger the share of R&D costs and technology development costs in the overall costs needed to put out a certain product or to provide a certain service the higher-tech these manufactures and services are perceived to be. In contemporary economy competitiveness even in low-tech manufactures hinges mostly on innovation in the technologies employed in the manufacturing process. If we take for instance the furniture manufacture which is a typical example of a low-tech manufacture according to the OECD, it would not be competitive without the application of modern information technologies or products of the chemical industry that are typical high-tech manufactures.

The significance of high-tech manufactures is determined not so much by their direct share in and contribution to the GDP growth, as by the increase in the competitiveness of every manufacture where they are in application.

A number of important instruments have been elaborated and enacted in Bulgaria over the last 4 years which affect to a different extent this country's policy in the area of technological development. In most cases such instruments determine the strategic role of the country's technological development but there remains the overall impression of insufficient congruity between them. On the other hand, these instruments outline many an excellent intention but have brought about very little practical benefits for the development of technologies in Bulgaria. Nevertheless they could be used as a springboard for more purposive actions to encourage and enhance technological development.

This analysis outlines current policy trends in regard to technologies in Bulgaria. A research has been made into the scope and objectives of strategic documents adopted by the principal government institutions in relation to the technology policy of the Republic of Bulgaria.

An attempt has been made to present an inclusive picture of technology policy making at the macro-level allowing to identify its merits and shortcomings at this moment without looking at the development of governmental technology policies in retrospect. Extensive use has been made of mainly primary sources of information

such as statutes, strategies and suchlike legislative instruments immediately relating to Bulgarian economy's technological development. In view of this paper's analytical nature, it does not provide full description of the said documents but rather makes an analysis of the goals and objectives set forth therein. To facilitate readers who might wish to familiarize themselves in more detail with the documents used as information sources a Table has been attached providing the Internet sites where these could be found.

This paper could be viewed as a Bulgaria-focused extension of the review styled *European Countries' Policies in the Area of Research and Development and High Technology* (http://www.ced.bg/bg/projects/project11/research/hi_tech.pdf in Bulgarian only), outlining the key general trends in high-tech development policies in European countries. That research focused on national policies to develop R&D, technologies, and innovation and presented also some aspects of the R&D development policy in the EU. Similar assessment criteria borrowed from the European Union and the OECD are employed in this analysis of Bulgaria's technological policy.

The OECD gives recommendations to member-states for policy development in six areas in support of technology and innovation[2]:

- Stimulate technology diffusion and links between universities and enterprises.
- Strengthen the evaluation of technology and innovation policy.
- Strengthen and reform the science base.
- Enhance the efficiency of incentives for business R&D.
- Facilitate the growth of new technology -based firms, incl. venture capital and new business start-ups.
- Strengthen frameworks for policy formulation and implementation.

The must components of governmental policies include their objectives, scope, and the organizational and executive structures tasked with policy implementation, as well as a system of evaluation and control.

These same criteria have been used to provide a basis for evaluation of technology and innovation development policy in Bulgaria.

2 OECD Science, Technology and Industry Outlook 2000, p. 61

Scope and Objectives of Principal Strategic Documents and Programs Immediately Related to Bulgaria's Technology Policy

There have been three main directions of Bulgaria's technology policy development over the last decade - information society, high technologies, and science and research.

INFORMATION SOCIETY (IS)

The information society in itself is not a technology but rather a manner of communication, requiring a particular technological infrastructure. It is an environment requisite for and conducive to the development of relationships in almost all domains of life. There is a two-way link between the IS and technological development. On the one hand, technology-oriented companies are a key factor in building up the infrastructure essential for IS. In this process the demand for the services and products of Bulgarian professionals and firms who best know the specific characteristics of the local environment will clearly increase. On the other hand, the improved infrastructure will render Bulgaria's technology sector more competitive and will attract foreign investment. In recent years Bulgaria has been pursuing a consistent policy in the information society area. Such policy reaches beyond technologies and determines the process of a new different-quality development of the entire society. This comprises areas such as:

- Governance incl. introduction of modern information technologies; uniformed information and communications environment; an information system serving the national cadastre (land, water

and infrastructure registry); security and defense; judiciary; statistics and monitoring of IS development.
- Economy including information and communications industry; small and medium-sized enterprises; e-commerce; banking and finance; transport; energy; agriculture; environmental protection; education and scientific research incl. training in information and communications technologies (ICT) - opportunity for all; continuous and individualized education; a new model of scientific research development; access to global information networks; libraries.
- Social and cultural sphere including labor and social policy, healthcare, culture, electronic media and audiovision.

The founding document in this area is the *Strategy for the Development of Information Society in the Republic of Bulgaria*. It is an all-embracing document of Bulgaria's government outlining the entire complex of issues characteristic of Bulgarian information society. Such document defines the main features of IS:
- Application of information and communication technologies in all economic and social activities;
- Demassing of social and economic processes - production of small series of products, market segmentation, disintegration of some of the large industrial corporations, etc.; high employment in the service sector - more than 50 percent of all workforce;
- Continuous qualification process in a dynamically changing world - life-long education and self-education;
- Increase in each individual's social role - changes in the nature of labor and management expand each person's responsibility;
- Globalization, economic and social uniformity - provision of favorable conditions to build a 'borderless society', to eliminate distance as a factor, to move towards social uniformity.

The direct link between IS and the technology industry is reflected in the *Information Society Development Strategy*'s subsection 5.2, *Economy*. It clearly points out the need to develop production of information and communication technologies in Bulgaria, which would create jobs for highly qualified specialists and would limit the brain drain. The *Strategy* recommends that high-tech parks establishment should be regulated by legislation as an organizational form of accelerated information environment development.

The second area of technology development the *Strategy* focuses on are SMEs operating in the field of ICT which will launch new manufactures in the information and communications industry and will open new jobs in such areas as software technologies, value-added services, electronic commerce, etc.

A *National Program for Information Society Development in the Republic of Bulgaria* was drawn up in harmony with the *Information Society Strategy*. The updated version of such *Program* envisaged in its subsection 3.2, *Economy*, that as early as in 2001 the appropriate documents would be enacted with regard to the two main priorities having a direct bearing on the development of Bulgaria's technology industry:

- Legislative regulation of high-tech parks establishment with the Minister of Economy acting as the responsible authority.
- Elaboration of a program for SME involvement in IS with the Minister of Economy and the Chairperson of the Agency for Small and Medium-sized Enterprises being the responsible authorities.

Electronic commerce is an inseparable part and a leading information society factor. In this context a *National Electronic Commerce Development Strategy* was adopted by a Council of Ministers' Decision of June 2000 which is viewed as part and parcel of the *National Information Society Development Program*. Its main objective is '*to have Bulgaria established as a fully adequate participant in the European and global electronic market, and a leader in the area of e-commerce in Southeastern Europe*'.

Comprised in the scope of such document are:

- Nature and essential characteristics of e-commerce inclusive of international practices and solutions, as well as the need and prerequisites for e-commerce in Bulgaria.
- Goals and objectives of e-commerce development in Bulgaria including its main principles and tasks, sources of financing, and the functions of the government, the private sector, and the public.
- Legal and regulatory framework including legislative regulation and standardization.

Another decisive step having a bearing on the development of Bulgaria's information society was the enactment of the *Electronic*

Document and Electronic Signature Act drafted and passed in 2001 in line with the *National Strategy and Program for Transition to Information Society*. This Act's main objective was to confer upon electronic documents the same legal status as that of written documents thus opening the way to Internet transactions and electronic economy development with its full range of numerous applications from banking to electronic notary office. At the same time, the broad application of electronic signature is linked to the need to ensure confidentiality, privacy, personal inviolability, and security as the basic principles of electronic communication. The Act regulates electronic documents and electronic signature, as well as the procedure of providing certification services.

The *Electronic Document and Electronic Signature Act* could not enter into force unless **subordinate legislation acts** are drafted and enacted to regulate in detail essential yet specific issues of technological nature or of purely legal nature. There are a number of other issues whose further settlement is impending, e.g. taxation of Internet transactions. Major problems[3] anticipated to accompany the implementation of the regulations at issue relate to:

- Lack of trained specialists in public administration.
- A need to prepare for the universal electronic signature's introduction in the operations of both the government and the municipalities.
- Insufficient preparedness on the part of potential certification service providers as regards problems and issues of legal regulations.
- Compatibility with possible parallel certification systems, e.g. in the banking sector, etc.

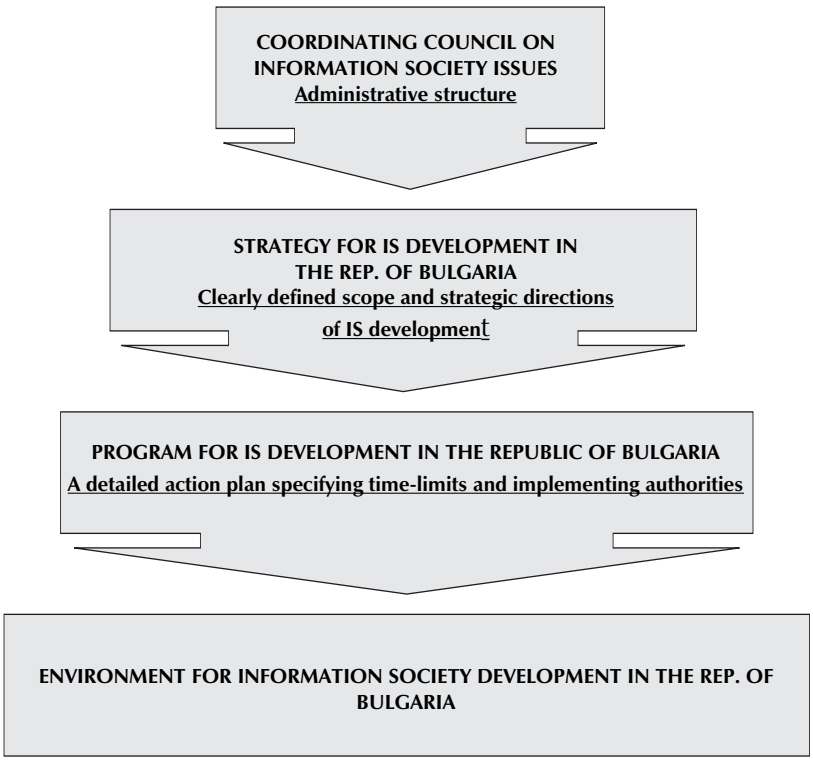
Electronic commerce would undoubtedly produce considerable positive effects on Bulgarian economic environment. It would have an immediate impact on the technology sector as well, which would, apart from the improvements in the business environment, gain experience in building the relevant technological and information infrastructure.

The *Strategy for the Development of Information Society in the Republic of Bulgaria* and the updated program for its implementation are key documents whose realization is crucial for the development of social and economic life in Bulgaria. Bulgarian companies would

3 Ognyanova N. , *Analysis of Bulgaria's Technological Development,* CED 2001, p. 40

be able to compete successfully in the global market only in a well-developed information infrastructure synchronized with European and world standards. It is definitely a positive fact that Bulgaria is willing to take up this challenge and has been establishing a framework for IS development covering all stages of strategic planning in a country.

Figure 1. Structure and organization of Bulgaria's IS policy



HIGH TECHNOLOGIES

The National Strategy for High Technology Development in Bulgaria is a structure-setting document outlining major directions of technology development in Bulgaria. Such strategy was worked out by the Ministry of Economy (former Ministry of Industry) and was adopted by the Council of Ministers of the Republic of Bulgaria. It was the first document in Bulgaria after the changes in 1989 that identified comprehensively the government's mission and priorities in pursuing a technology policy and in particular a high technology development policy.

In the beginning the Strategy discusses the role of high technologies in present-day economy and social development (Chapter One) and provides a definition of high-tech manufactures. Such definition accepts a limit of 8-percent share of R&D costs with overall production costs. Such share is rather high and corresponds to most high-tech manufactures in OECD countries listed in Table 1.

Chapter 2 features a brief analysis of present conditions for high-tech business activities in this country. It examines all factors having a favorable or unfavorable effect on technology development environment. The Strategy defines as unfavorable the following factors:

- Intensity of activities in the field of science and technology measured as a share of GDP has dropped.
- Companies' research and development costs have been rapidly declining (more than tenfold over the period from 1989 to 1998).
- There has been a considerable cut-down in science and research costs in the defense industry.
- Involvement of universities in research and development has been poor.
- The ratio between fundamental and applied research is entirely in favor of the former.
- R&D cost structure does not stimulate research in the area of high technology: 57 percent of them are labor costs, operating costs amount to 38.1 percent, while capital expenditures inclusive of those for apparatus and appliance renovation amount to 4.9 percent.
- The number of Bulgarian patents registered in this country and abroad has been declining.

On the favorable factors' side are the existence of a considerable scientific potential, laboratories and production facilities, as well as the rather good educational system. There have been also certain positive trends in the environment such as the emergence of a large number of SMEs in the technology industry, some extremely successful firms in the area of IT and microelectronics, and the existence of firms facilitating high technology development. The Strategy's main objective (Chapter 3) could be presented in brief in three mutually linked sub-goals:

- Establishment of a significant and dynamic high-tech sector based on highly qualified labor and scientific achievement.

- Introduction of high-tech manufactures and services in all sectors of Bulgaria's economy which should lead to improved input consumption, energy consumption, and environmental characteristics of manufactures in Bulgaria.
- Increase in the labor remuneration and social status of highly qualified specialists working in this country by stimulating an accelerated economic growth.

The document sets the country's technological priorities (Chapter 4). These include the development of high technologies in Bulgaria based on provision of financial, material, and intellectual resources. Another group of priorities relates to the market realization of high technologies with a view to enhancing the country's overall technological development and increasing companies' competitiveness. The Strategy defines opportunities to develop high technologies by changing organizational structures (type of property, foreign investment, and SME development). It enumerates the areas of technology development that are deemed to be of priority to this country, i.e. IT, telecommunications, communication equipment and services, microelectronics, micromechanics and microsystems, new materials, chemicals and components, energy, electrical industry, energy efficiency, utilization of alternative and renewable energy sources, systems and means of automation and robotics, electronics, instrument building, medical technology and scientific research appliances, biotechnology, pharmaceutics, precision chemistry, new plant varieties and animal breeds, genetic engineering, medicine, improvement in quality of life, prevention of and control over environmental pollution, sustainable development, management technologies.

Chapter 5 identifies three main areas of governmental influence on the development of high-tech activities:

- General conditions including legal environment, fiscal environment, foreign trade policy, standards in education and human resource management, development of transport and telecommunication infrastructures, finance, development of industrial structure, competitive environment, and corporate culture.
- Renovation of the country's scientific base through the system of technical and higher education, development of fundamental research and R&D, support for innovation through funding programs.

- Transfer factors - support for communications between companies, research centers, and the administration, strengthening international relations by establishing networks and databases for knowledge transfer, codification of knowledge in patents, etc.

The Strategy provides the basic concept for the establishment of high-tech parks as a tool of implementing the government policy to develop high-tech activities in this country (Chapter 6). They are regarded as an essential element of integrating research centers, institutes and universities into the market environment. Technology incubators, which have to be an integral part of high-tech parks, are designed to stimulate the start up of small and medium-sized enterprises specializing in high-tech manufactures and services.

Measures are envisaged in Chapter 7 to ameliorate the legislative regulation of high-tech activities. Such measures relate to the enactment of a *High-tech Activities and High-tech Parks Act*. In addition to the drafting of such statute the Strategy examines the need to coordinate all legislation regulating scientific research, education, copyright and patent law, SMEs, etc.

The adequate taxation for high-tech manufactures referred to in the Strategy (Chapter 8) relates to a large extent to high-tech parks. The Strategy suggests a possible replacement of the corporate income tax on high-tech parks and all companies operating in their territory by minimal taxing on the value of business income. It envisages also the setting up of specialized funds to support high-tech activities. It is suggested that high-tech parks be exempted from real-estate taxes. In addition to such measures applicable to high-tech parks the Strategy proposes also wider-range measures such as considering exports of high-tech services to be exports in the meaning of the *VAT Act*, or granting tax credit for the provision of such services.

In view of market mechanisms in the area of technology sectors, the Strategy identifies fields for allocating government resources to the development of high-tech activities (Chapter 9). Such resources need to be marshaled with a view to indirectly encouraging the high-tech sector by covering the cost of high-risk research and development, by providing access to laboratories and equipment, which private companies are not in a position to provide for themselves, by funding information and data exchange, through international contacts, training and specialization of key experts, etc. Recommended project whereto such resources should be allocated include:

- Projects relating to the construction of high-tech parks' infrastructure, i.e. buildings, communications, etc.
- Provision of information.
- Support for organizing international conventions, seminars, and other suchlike events.
- Funding the establishment of incubators for the high-tech firms operating within the parks.
- Support for setting up base laboratories and acquisition of equipment necessary for the development of research projects having a considerable potential market effect.

Organizational measures to implement the government policy in the area of high-tech activities in fulfillment of the Strategy (Chapter 10) require that the Council of Ministers should adopt on a motion of the Minister of Economy annual programs for the encouragement of high-technology businesses in this country. Such programs should identify specific measures and responsible authorities in the various fields of governmental influence. The need is pointed out to establish an advisory board made up of representatives of various ministries, experts on behalf of business and NGOs, universities, and the Bulgarian Academy of Sciences (BAS). This Board is to be chaired by the Minister of Economy.

A *High-tech Activities and High-tech Parks Bill* was drafted in step with the Strategy and passed at the first reading by the National Assembly. The Bill's objective was to develop in detail all requirements, procedures, and measures relative to the establishment of high-tech parks in their capacity as the basic tool to provide support to high technologies in Bulgaria. Regulated by such Bill are the high-tech parks and the companies operating within them. In respect of them the Bill has developed in detail all measures pertaining to HTPs in the *National High-technology Development Strategy*, incl. the option to pay final tax on the value of business income instead of profit tax and municipality taxes. 50 percent of such tax shall be ceded to municipalities. The Bill provides also for different tax treatment under the VAT Act. Pursuant to the Bill, HTPs shall be required to set up Project Funds - for infrastructure and equipment, and a reserve fund to cover the park's annual loss. The draft law regulates also the institutional framework relating to high technology policy. Such framework comprises the organizational procedures and the structure of a High-Tech Board under the Ministry of Economy, the procedures to adopt a

National High Technology Program, etc. The features of the *High-Tech Parks Bill* as described herein are rather conditional to the extent that there exist several drafts of the said Bill and it is not completely clear which one will be submitted to the Parliament for final consideration and enactment.

The *High Technology Development Strategy* and the *High-tech Activities and High-tech Parks Bill* were elaborated by a working group of established experts with the Center for Economic Development. The initial idea was to regulate the status of high-tech parks and then to develop through them the infrastructure needed to maintain high-tech industries. Tax concessions envisaged for companies registered in a high-tech park were considered a needful incentive, but the Bill's best merit is that it would give expression to the government's intent to create a HT-friendly infrastructure, which would be then useable by any entrepreneur having enthusiasm, knowledge, and skills in the high-tech domain.

It seems that some entrepreneurs misunderstood the idea, which aroused criticism in four areas:

- The mechanism of management and administration of high-tech business activities and high-tech parks.
- The restricted territorial applicability of tax concessions only to companies operating within a high-tech park.
- Some argued that HTPs needed no special measures, not even a statute to regulate them, since they could operate as market players.
- Suspicions were even voiced that the statute was drafted to 'benefit' certain companies and organizations.

Criticism was combined with a number of additional demands some of which were quite timely and justified. These include the request that VAT rules applicable to exports of services and software should be uniformed with those applicable to commodities, while depreciation period for computers and R&D-related equipment should be reduced to 1 or 2 years. Some other ideas, such as the suggestions to enact a Transfer of Programmers Act and a Government Protection in Public Procurement of IT Services were of rather exotic nature.

By mid-2000 certain amendments had already been made, the most significant of which relate to:

- The possibility to incorporate a commercial company as a high-tech park, which provides automatically the solution to problems concerning park management since it will be no different essentially from the management of any company.
- A possibility was provided for any trader engaged in a high-tech business activity, whether or not within a park's territory, to benefit from the tax arrangements as stipulated by the Act thus conferring equal legal status upon all high-tech companies regardless of whether they operate within or outside of a high-tech park.

Structures akin to high-tech parks could operate as commercial entities under the general trading practice in this country without special support by the government, but they would not be sufficiently efficient in attaining the goals of both the public and the government because of the existing „market failures" (see page Introduction hereinabove). This is why most technology parks worldwide are organized in such way as to „correct" market failures and in addition to produce some quite practical results for their founders:

- The government
  - Increases in employment rates and retention of highly-qualified specialists by providing conditions for the establishment of high-tech firms in specialized incubators;
  - Higher national competitiveness through increased competition based on technology and knowledge.
- The regional authorities
  - Concentration of business activities in the municipality hosting a high-tech park leading to increased direct and indirect service consumption, higher regional employment, and higher revenue collection;
  - Improved infrastructure in result of intensifying investment activities.
- Educational institutions
  - Possibilities to „commercialize" science and to gain access to finance to reinvest in their scientific research facilities.
  - Access to practical experience in the field of research.
- Businesses
  - Higher company competitiveness in result of their access to novel ideas, working with highly-qualified specialists and innovative SMEs;
  - Modern infrastructure for research and technology-based industries including specialized business services;

- Easier access to venture capital.

On the one hand, it is only logical that satisfying the interests of all aforementioned institutions engaged in high-tech parks would bring about considerable synergistic effects which would not be achievable separately. On the other hand, it is necessary to strike the right balance between the interests of all various persons involved, which should be realistically reflected, in both the investments and in the high-tech parks' management.

As regards fears of „benefiting" certain companies and organizations, time has proved that the companies referred to back then are currently the leaders in high-technology and in the IT sector in particular even in the absence of a law. Most indicative is the example of the Rila Solutions Company, which is a Microsoft Gold Certified Partner in two areas and despite the stagnation in IT corporate financing worldwide, the company experiences no problems in raising the funds for its development even from institutions such as the EBRD.

Encouragement of applied research and new technology introduction is set out as a prime priority in the *Industrial Policy* Chapter of the *2000-2006 National Economic Development Plan*. Measures envisaged to implement such priority include:

- Enhancement of technology levels and development of high-tech industries;
- Setting up the legal basis for the development of high-tech industries;
- Gradual increase in science and research expenditures;
- Support for the development of innovative industries such as computer systems and software, telecommunications and communication equipment, pharmaceutics and medical equipment, biotechnology, systems and implements of automation and instrument building, research apparatuses and appliances;
- Establishment of high-tech parks and technology incubators.

The main priorities relative to technology development are laid down in the *National Strategy for the Encouragement of SME Development* as well. One goal of such strategy is defined as „introduction of high-technology manufactures'. To facilitate and improve financial services, the Strategy envisages a policy designed to ensure eco-

nomic growth and to provide conditions for easier access to loans and venture capital financing for SMEs. Some of the tools to improve the competitive environment which have a direct bearing on SMEs' technology policy include encouragement of innovation in product manufacture and in service provision, as well as technology transfer to SMEs by overall facilitation of the investment process. Measures to encourage SME development are further elaborated in the *Working Program for the Implementation of the National Strategy for the Encouragement of SME Development*. Short-term initiatives (until 1998) envisaged in the Program included the establishment of a partnership network of public, non-governmental, and business entities with a view to producing a synergistic effect in supporting SMEs. Medium-term initiatives (1998-2001) include encouragement of SME cooperation with R&D units, with technology and innovation centers, and with universities for the purpose of solving specific technical and technological issues, technology transfer, and for joint participation in scientific research programs sponsored by the European Union.

Two of the priorities set out in the *Small and Medium-sized Enterprises A*ct relate to technology development. These are linked to the encouragement of high-tech SMEs and SMEs engaged in development. Pursuant to the Act all ministries and agencies, in line with their competence, shall stipulate in their industry programs measures to increase the number of high-tech SMEs.

The *National High Technology Development Strategy* is a programmatic document of Bulgaria's government and is not mandatory by nature. Notwithstanding its merits and the support it received among broad business circles and various groups inclusive of the *Bulgarian Easter* Initiative, it has failed to bring about any actual action and effect over the last two years. This is due in part to the delay in the enactment of the *High-tech Activities and High-tech Parks Bill* under pressure coming from the Bulgarian Association for Information Technologies.

The Strategy has certain shortcomings related to its preoccupation with one of the tools to encourage the country's technological development, i.e. HTPs. However, it is the first government document covering in a systematic way all major priorities of Bulgaria's technology development. One of its best assets is the establishment of an institutional framework for current planning and implementation.

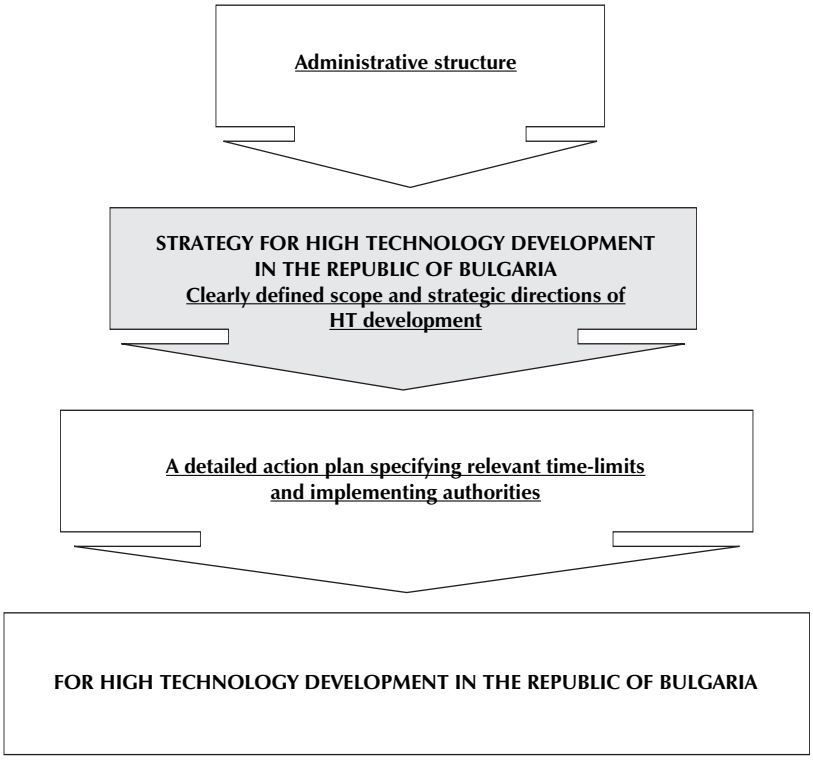
It has proved difficult in the last nearly two years since the *High Technology Development Strategy* was adopted to reach a consensus as regards its implementation and the enactment of the main piece of legislation regulating the „good intentions" set out in it, i.e. the *High-tech Activities and High-tech Parks Act*. Many is the good idea coming from both business and the various structures of the government that remain unrealized in waiting for the provisions of the *High-tech Parks Bill* to enter into effect. The absence of a law, however, is not an impediment to the establishment of such parks. Conversely, the launching of structures having similar functions has already started. In July of 2000 the Institute of Microelectronics Technology Center became the first Bulgarian member of the International Association of Scientific Parks (IASP), and in May of 2001 the *Linder* construction grouping of Germany started the construction of the *Sofia* Business Center oriented to technology companies. Once again the business was first to react and forecast the enlivening of Bulgaria's technology companies and set out to satisfy the needs - contemporary infrastructure and environment conducive to exchange and cooperation of ideas. This trend is extremely positive. The government, however, is in a position to support and expedite the process by assuming its responsibilities to business' technological development and by setting up its share of the environment and namely by making improvements to the shared part of technological infrastructures, establishing an environment conducive to the start up of new technology businesses, i.e. technology incubators, developing venture capital financing, and last but not least, by encouraging business, research institutes, and universities to interact and cooperate and sponsoring most prospective projects involving high market risk.

The best place to implement technology development measures in practice are the so called „technology parks". Technology parks or similar structures will be established in all developed countries with the consent of the government and without a special law in place. Those countries, however, (1) did not have to undergo so abrupt a restructuring of their technological infrastructures, and (2) their governments have clearly defined frameworks for their technology policies and invest directly in technology parks. **Bulgaria has the option to either take the direct investment approach which does not require the enactment of special statute but requires availability of enormous funds, or to enact a law thus motivating private business to make available a portion of the funds needed in exchange for certain fiscal concessions.**

As is the case with the *High-technology Development Strategy*, the better part of the guidelines concerning SMEs' technological development have remained on paper while in a world of market globalization Bulgarian SMEs would not survive the competitive pressure unless they are at least „technologically literate" and aware of their European competitors' level.

A chart of the technology development policy's structure (see Figure 2) will indicate that unlike the IS situation, in the case of technologies only the second level has been implemented, i.e. the definition of strategic objectives.

Figure 2. Structure and organization of Bulgaria's high technology policy



POLICY IN THE FIELD OF RESEARCH AND SCIENCE

Technology policy lays very little store by the interaction between technology and research even though these are the two sides of one and the same coin. In most developed countries it is normal to talk of a policy in the area of research and technology.

Pursuant to **Council of Ministers' Decree No. 56 of 1995** Bulgaria's policy in the field of education, science, and technology shall be formulated, set and implemented by the Ministry of Education. The said ministry is tasked with developing the main strategic priorities relating to research and the development of science, technology, and education:

- National strategy;
- National priorities;
- National programs;
- Programs for qualification and specialization of human resources.

The Ministry of Education and Science (MES) carries out a program to stimulate projects designed to realize scientific research results. Funds are allocated to stimulate:

- Transformation of applied research results into protected intellectual property products and their utilization for putting out competitive products, or for transfer by way of licensing;
- Research and projects relating to the implementation of the national research and technology policy and infrastructure;
- Support for Bulgarian institutions, organizations, and SMEs in their participation in EU applied scientific research and technology development programs.

A **Technology Development Council** was set up with the Ministry of Education and Science with the adoption of **Rules for Stimulating Projects Designed to Realize Applied Research Results**. This Council is tasked with:

- Formulating and proposing to the Minister of Education and Science the country's priorities in the area of applied research and technology development. The Minister then presents such proposals to the **National Council on Scientific and Technological Policy**.
- Ranking proposals in competitions organized by the MES to stimulate projects designed to realize applied research products.

This program's scope and scale are rather limited and there is absolutely no coordination with the Ministry of Economy which controls more human and information resources in the field of industry.

Collaboration between science, education, and industry is not set out as a priority in normative documents concerning research institutes and higher-education establishments. It is very difficult to find any provision among the objectives laid down in the *Higher Education Act*, the *Bulgarian Academy of Sciences Act* and the *BAS Statutes* defining the priority of technological research and cooperation with the most flexible operators in Bulgaria's economy - the SMEs. The lack of priorities in this area is indeed a gap in the policy but this does not mean that research institutes and universities which are very much independent in taking their decisions are restricted to collaborate with the real economic operators.

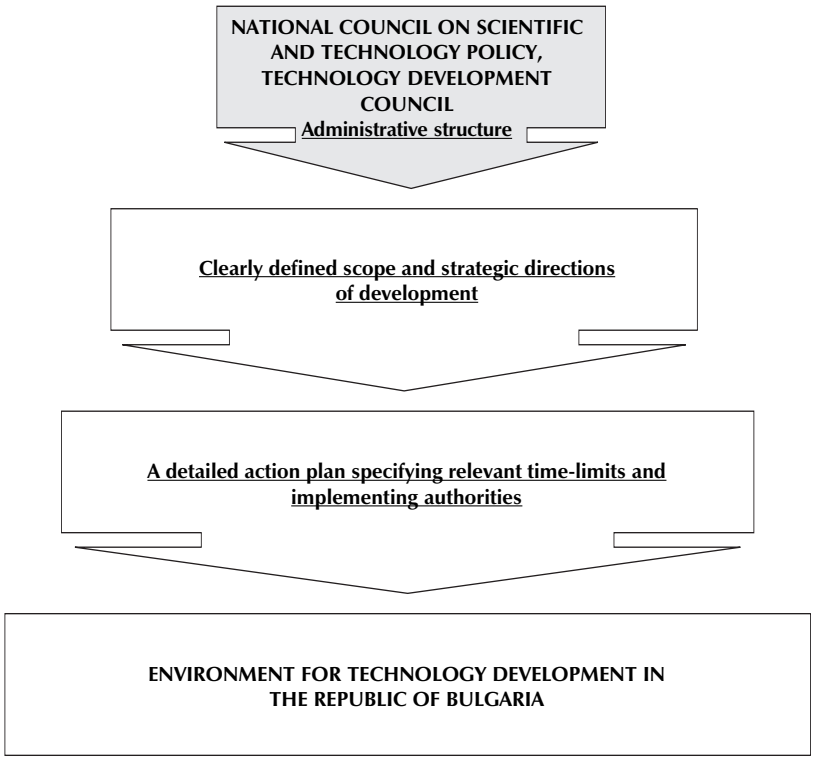
Notwithstanding the legislative requirements introduced with the **Council of Ministers' Decree No. 56 of 1995** concerning the development of strategies and priorities in the field of research policy and the development of science, technology and education, there exist no widely known strategic documents at the governmental level. Sufficiently illustrative of the priorities and transparency in formulating government policy in the area of science and research is the fact that by June 2001 of all three administrative structures within the MES in charge of this area, i.e. the State Scientific Policy Directorate, the Scientific Research Directorate, and the Applied Research Directorate, only the latter had opened its web-site on the Internet.

The situation is a little better in the area of international cooperation mainly under the Framework Programmes of the EU. There the MES has been much more active and in close cooperation with the non-governmental sector has been providing information and support for Bulgarian institutions' participation in international projects.

As is evident from Figure 3 below, only the administrative structure in research policy is really in place. At all other levels official documents are lacking or they are not known to the general public.

Bulgaria's policy in the field of research is illustrated graphically in the Figure below:

Figure 3. Structure and organization of Bulgaria's research and technology policy



Analysis of the General Framework for Research and Technology Development in Bulgaria in Accordance with OECD-Recommended Criteria

The environment for technology development is a complex set of conditions for business development and conditions for research. The development of these two elements *per se* does not automatically create favorable environment for technologies. Technological growth requires very good synchronization of all elements of the economic environment. Table 3 gives an idea of the fields of activity of the various documents relating to Bulgaria's technology policy.

The general framework for **technology diffusion and links between universities and enterprises** in the Republic of Bulgaria is actually limited to the allocation of budget funds for the Bulgarian Academy of Sciences (BAS) and financing small research projects through the Applied Research Directorate of the Ministry of Education and Science (MES). High-tech parks would also contribute substantially, as they are the natural environment for technology dissemination.

The encouragement of technology dissemination and linkages between universities and industries still remains beyond the list of top priorities in the legal framework for development of science in Bulgaria.

The EU has introduced the only modern instrument for encouragement of joint research, which is operational in Bulgaria. This is the Fifth Framework Programme. It is provided with the necessary network of contact persons and institutions and is developed horizontally; i.e. it ensures the necessary level of competition of various

institutions and/or companies. One of the Programme's greatest merits is the requirement for broad international representation. Apart from the Fifth Framework Programme, Bulgarian research institutes and universities take part in a number of other programs such as the NATO Research Programme, programs based on bilateral agreements, etc. International programs are an essential aspect of the general framework for the development of Bulgarian technology policy at all levels and the country's participation in such programs is defined as a major priority in almost all strategic documents.

Networking between enterprises, research centers, and educational establishments is a very efficient tool for technology dissemination. The encouragement of such networks is a major priority in the programs of developed nations and the EU. Bulgaria still lacks a clear concept on these issues.

The effects of government policy on the development of science, technology and innovation can be seen in the long-term perspective, while impact tools require vast human and financial resources. If no efficient tools are used for **ongoing evaluation of technology and innovation policies**, the government wastes a lot of resources and most of all time to adjust its conduct. The opportunities for effective evaluation are to be developed as early as at the phase of drafting the policy, the strategic documents and the related action plans. It is impossible for any policy to be properly evaluated without any evaluation opportunities provided by the policy itself. Clear-cut criteria for evaluation of the strategic and operational objectives and tools need to be developed as early as when these objectives and tools are defined.

Such criteria can be identified only in respect of information society among all three directions for the development of Bulgaria's technology policy. These criteria are included in the *National Program for Information Society Development in the Republic of Bulgaria*, where each measure is specified in terms of time limits and institutions responsible for its implementation making it possible to assess the Program's implementation as well as to identify responsibilities. What this document lacks is a precise definition of criteria for assessing this policy's impact on society, e.g. increased use of the Internet, higher e-commerce volumes, increased share of administrative services provided through the Internet, etc. There are almost no assessment criteria in the other two directions.

It is a positive fact that all three directions provide for updating implementation programs on an annual basis, which ensures flexibility in the attainment of the objectives and opportunities for adjustment but this requirement is currently met only in the IS field.

OECD countries make „technology foresight" in order to outline the current condition of domestic research in comparison to the most advanced countries and to identify future prospective areas. The best examples of such research in OECD countries include: the United States - Critical Technologies; Japan - Delphi Study; the United Kingdom - Delphi Study; Germany - Delphi Study; France - Key Technologies.

Generally speaking, technology foresight and evaluation studies in developed countries contain some essential elements that do not depend on the specific methodology or scope of the research. These elements are:

- *Technology foresight is considered to be a continuous process*, which is continuously improved and maintained. In most cases research related to technology foresight in developed economies is either continuous or subject to current updating;
- *Research activities are coordinated by a team comprised of representatives of the government, the academic community and industries*. Coordination and management of technology foresight research invariably involve representatives of all three major groups of decision-makers in the field of science and technology: government, research institutes and universities, and industries;
- *The comparative analysis of achievements by comparison with the most technologically advanced countries* is a major tool for technology level assessment. Studies in each country make comparisons to other developed countries in order to identify its place in the context of world peak achievements.

The science base reform is a critical area for all economies in transition. Like all other former socialist countries, Bulgaria developed research activities within a strictly hierarchical and specialized innovation system. Universities and higher education institutes were confined to the conduct of research, while the Academy of Science and specialized sectoral institutes were responsible for fundamental and applied research respectively. Notwithstanding some signs of certain progress achieved in the research reform process, such as the autonomy granted to the establishments of higher learning, Bulgaria

has not attained substantial progress in the development of its science base yet. The direct vinculum between universities and their major business „customers" is very weak, while the former sectoral research institutes have very limited capacities to adapt to new market conditions.

In addition to these negative observations, one can identify some positive trends as well, such as:

- Enhanced autonomy of research institutes.
- Increased competition for winning international research projects.
- Establishment of some companies and research centers, which have either spun off Bulgarian universities or are closely linked to them.

The Bulgarian Academy of Science (BAS) is a tool with a quite sluggish impact mechanism, which restricts competition in the appropriation of the substantial resources allocated to science development in Bulgaria channeled mainly to the BAS structures. The Republic of Bulgaria's 2001 budget provided approximately 40.8 million Bulgarian leva for BAS funding, which is tantamount to 16.5 percent of aggregate expenditures for the BAS and all public higher-education establishments and amounts also to 0.6 percent of overall budget expenditures. This renders the BAS a government-funded research institute involved mainly in fundamental research. No evidence exists as to any link between such government funding and some specific industrial or research objectives directly related to the enhancement of Bulgarian industry's competitiveness. On the other hand, this is a case of institutional investment, which rules out any competition between the proposals of, say, universities and BAS research institutes.

The OECD has developed the following principles of research base financing[4]:

- Maintain or increase overall government support to university and public research with a long-term view.
- Maintain and establish an adequate ratio between sure and precarious resources for university research at the overall level (around 70/30 per cent); at the institution level, maintain a minimum percentage of 50/50 between core and contract-based funding (on average).

4 OECD Job Strategy - Technology, Productivity and Job Creation - Best Policy Practices, p. 161

- Maintain a minimal level of government research of collective interest and establish funding mechanisms accordingly.
- Separate criteria for funding of basic research (excellence) and applied/technical research (relevance).
- Maintain a minimal level of effort by appropriate subsidies and tax incentives for in-house research.

Except for some initiatives of the Ministry of Science and Education, Bulgaria has **no R&D incentives** applicable at present. Some fiscal incentives will be introduced after the adoption of the *High-tech Activities and High-tech Parks Bill*. OECD countries apply various incentives for research and technology development, ranging from corporate income tax credit to subsidized R&D jobs in SMEs.

Depreciation rates for R&D in European countries vary within a wide range, depending on the specific country or the purpose of expenditures. Operating costs for R&D are fully depreciated within a calendar year, while in the case of machinery and equipment expenses depreciation rates range from full depreciation within one year in Denmark, Ireland, and the United Kingdom to ten years of straight-line depreciation in Italy. Even greater discrepancies exist with regard to building depreciation, while observing the same country pattern: full depreciation in the course of one year in Denmark, Ireland, and the United Kingdom and straight-line depreciation for 40 and 33 years in Belgium and Italy, respectively.

In France, the Netherlands, and Spain a tax credit is provided for R&D, which is then deducted from the corporate income tax. The base in the Netherlands is the level of R&D costs, while in France it is the growth of revenues above a certain level. Spain applies both approaches. Tax credits exists to a certain extent outside Europe, too, e.g. in Canada, Japan, and the United States. Additionally, Belgium, Denmark, and the Netherlands provide opportunities for accelerated depreciation of certain R&D-related assets, such as operating costs, machinery and premises.

The most successful European schemes of tax incentives and subsidized R&D-related employment are considered to be those in Denmark, France, Germany, Ireland, the Netherlands, and the United Kingdom. These schemes are beneficial primarily to small and medium-sized enterprises, which find it difficult to join big government-sponsored research projects due to their size and nature of business.

Tax credit schemes operate in France and Spain. Denmark provides greater tax incentives for fundamental and international R&D. The Dutch tax-incentive scheme is based on labor costs. Austria provides tax incentives to inventions defined as „economically significant". Portugal has introduced schemes to assist the recruitment of staff with master's or doctoral degrees. Two schemes in the Netherlands and Denmark for self-employed and external researchers, respectively, offer direct tax incentives to researchers.

The small-scale schemes of more limited application usually offer better-targeted impact and more substantial funding of a specific application. These are the Techman scheme in Ireland or TCS and KIM in the Netherlands. The schemes providing tax incentives are the most costly ones but they can also be the most efficient schemes for the creation of a favorable environment for R&D as a whole.

In Bulgaria, the business environment is not particularly favorable for the establishment of new technological companies. **Ensuring the growth of new technological companies, including venture capital encouragement and support to start-ups, is underdeveloped** and there are no incentives for its application. On the other hand, the general terms and conditions for financing are unfavorable for start-up companies, which have almost no access to bank lending.

The country has no technological incubators. Technological incubators as part and parcel of high-tech parks in the *Strategy for High Technology Development in Bulgaria* would produce a very positive effect on the development of research in SMEs. Furthermore, they will become generators of technological micro-businesses, providing technological renovation to other SMEs. OECD countries develop technological incubators and provide also direct incentives for venture capital investment in various ways, including government venture capital funds (Germany's TBG, for instance).

As is seen in Figures 1, 2 and 3, **the framework for formulating and implementing a research and technology policy** in Bulgaria is incomplete and there is lack of synchronization between its components. Coordination among the major institutions involved in technology development in formulating Bulgaria's technology development policy is poor. Information society is the only area where the policy has a more complete framework. There is no coordinat-

ing body in the area of technologies to define common priorities and to seek the synergy of all three areas related to the technology policy in Bulgaria.

The OECD recommends the fundamental principle of incorporating policy in the field of science through appropriate mechanisms in the government decision-making process into the economic development strategy. Developed countries consider technological research to be a national priority and the coordinating bodies operate at the highest government level. Such bodies exist in Japan (Science and Technology Board), the United States (Office of Research and Technological Policy at the White House), Germany (Federal Ministry of Education, Research and Technology), Finland (Research and Technological Policy Board), etc.

Conclusion

The technological development policy of Bulgaria, as outlined in Table 2, has solid foundations in terms of intentions and priorities. The missing elements are the implementation of planned measures and the coordination of various bodies and strategies in this field.

In Bulgaria, the most complete policy exists in the sphere of the information society, where almost all elements needed for the attainment of strategic priorities are in place. The most serious constraint in the implementation process relates to resources, as there is shortage of financial and qualified human resources in the state administration.

The high-tech policy is well conceptualized and it has been the object of long public debate. The balance between the interests of business, education, and science has almost been reached but it cost society a delay of two years until now and it is unclear how long this delay will persist under the new government of Bulgaria. The measures outlined in the strategic documents relate to the adoption of a *High Technologies Act* (substantial progress has been achieved in this respect), the establishment of a coordinating body, and the preparation and implementation of a program. In terms of content and the purely strategic levels this policy is very well defined. High-tech parks are the major tool whereby great store is laid. As is seen in Table 3, they comply with all OECD recommendations on strengthening the technological development policy and operate as a universal tool. In accordance with OECD data, this tool is being used more actively in the less developed EU countries. Portugal is building a technological structure in the form of technological centers oriented to activities connected with industrial research between companies, research institutes, universities and technological parks. Greece is in the process of establishing a technological and research network (GR-NET) and four regional technological parks. Italy is developing 13 new research parks to encourage the development

and application of new technologies. Outside the EU framework, Turkey has already established structures that combine the features of high-tech parks and free industrial zones.

Bulgaria seems to pay the least attention to the public debate on the policy in the field of science and research. It is very difficult to obtain information about the work of Research Boards at the Ministry of Education and Science and the Bulgarian Academy of Sciences. No information is available as to the development and discussion of a national strategy in the field of science and research. The interaction with industries and the non-governmental sectors in the operation of various bodies is poor and does not feature as a priority or mechanism in the statutory documents regulating this matter. On the other hand, the *Knowledge in Action Program* of the Applied Research Directorate is a very useful tool but its resources are very limited. The greatest progress has been achieved in the establishment of structures to support the implementation of projects within the EU framework programs. A very important missing link in the implementation of Bulgaria's technological development policy is the „bottom-up" approach. This approach implies the development of regional technological development policies to be subsequently integrated into a national policy. The mechanism has been used in Bulgaria for drawing up the National Regional Development Plan and the National Economic Development Plan but there are no systematic priorities in the field of technological development yet.

The efficiency of Bulgaria's technological development policy would increase considerably with the encouragement of formal and informal networks for dissemination of knowledge. This is a very powerful tool for speeding up processes that have already started but it should be used efficiently rather than be imposed from outside. Practices in OECD countries come to show that networks created „from outside" often times exist only as long as they are artificially financed.

In closing, one can conclude that the foundations of the technological development policy have already been laid and what should follow is closer cooperation in the fields of IS, HT, and research and science for the actual implementation of the technological development policy aimed at enhancing Bulgaria's competitiveness. Undoubtedly, the coordination of the technological policy will make it much more efficient and understandable to businesses. *The establishment*

of a coordination body to synchronize activities in these directions of work would be appropriate with a view to achieving the necessary level of symbiosis. The efficiency of such a body will depend directly on the participants and it will be impossible to achieve it without striking the proper balance between government (individual ministries), businesses, research institutes, and the non-governmental sector. The operation of this body can build on the mechanism provided for in the *High-tech Activities and High-tech Parks Bill*. It has to coordinate rather than impose the strategic decisions relating to high technologies, including information society, applied and fundamental research, innovation, etc. The leading role in the decision-making process should be given to business and to people directly involved in research, innovation and high technologies, while the government should provide the necessary support to their implementation.

APPENDIX - TABLES

Table 1. Share of R&D Costs by High-Tech Industries[5] (%)

	DIRECT + INDIRECT COSTS			DIRECT COSTS			ADDED VALUE		
	MAX.	-	MIN.	MAX.	-	MIN.	MAX.	-	MIN.
High-tech industries (incl. aeronautics, office and computing equipment, pharmaceuticals, TV and communication equipment)	16	-	9	14	-	8	41	-	18
Medium high-tech industries (incl. research equipment, motor vehicles, electric machines, chemicals, other vehicles, machines other than electric ones)	5	-	2	4	-	1	9	-	4
Medium low-tech industries (incl. rubber and plastics, ship-building, other industries, metal processing, metallurgy, oil refining)	2	-	0.8	1	-	0.5	3	-	2
Low-tech industries (including pulp and paper, textiles and leather industry, foods and tobacco products, wood processing and furniture manufacturing)	0.7	-	0.6	0.2	-	0.1	0.6	-	0.4

5 Source: Second European Report on S&T Indicators, December 1997, EUR 17639

Table 2. Institutional Framework for the Implementation of the Technological Development Policy in Bulgaria

Institutions	Functions	Strategic Documents	Legislative Initiatives Directly Related to the Topic
Council of Ministers www.government.bg	Definition of the strategic priorities for the national development	National Regional Development Plan 2000-2006 http://www.government.bg/bg/oficial_docs/strategies/Plan_za_reg_razv.htm National Economic Development Plan 2000-2006 http://www.government.bg/bg/oficial_docs/strategies/aPNDP_final_text.html	
Ministry of Transport and Communications www.mt.government.bg	Policy in the field of information and communication technology	Strategy and National Program for Information Society Development in the Republic of Bulgaria, October 1999 http://www.mt.government.bg/bg/cpt/infosoc/str.htm	Electronic Document and Electronic Signature Act
Ministry of Economy www.mi.government.bg Sectoral and Regional Industrial Policy Department www.mi.government.bg/ind/reg.html	Industrial policy on the high-tech sphere	National Strategy for High-technology Development in the Republic of Bulgaria, December 1999 http://www.mi.government.bg/ind/hitech/docs.html?id=12985 National E-commerce Strategy, June 2000	High-tech Activities and High-tech Parks Bill
Ministry of Education www.minedu.government.bg **Applied Research Directorate**	Research policy	Encouragement of projects for the introduction of the results of applied research	
Agency for Small and Medium-sized Enterprises http://www.asme.bg	Policy for the development of small and medium-sized enterprises	National Strategy for Encouragement of Small and Medium-sized Enterprises http://www.asme.bg/bg/legal/strategy.htm Working Program for the Implementation of the National Strategy for Encouragement of Small and Medium-sized Enterprises http://www.asme.bg/bg/legal/workingprg.htm	Small and Medium-sized Enterprises Act http://www.asme.bg/bg/legal/sme_law.htm

Table 3. Spheres of Impact of the Major Documents Related to Bulgaria's Technological Development

Recommended Impact as per the OECD	Stimulate technology diffusion and links between universities and enterprises	Strengthen the evaluation of technology and innovation policies	Strengthen and reform the science base	Enhance the efficiency of incentives for business R&D	Facilitate the growth of new technology -based firms, incl. venture capital and new business start-ups	Strengthen frameworks for policy formulation and implementation
Strategy for Information Society Development in the Republic of Bulgaria, October 1999		Planned updating of the programs, which is implemented in practice	Improvement of the information environment is a major priority			Establishment of an IS coordinating body. Definition of priorities.
National Program for Information Society Development in the Republic of Bulgaria, October 1999	Adoption of a High-tech Parks Act	Clearly defined time limits and responsibilities	Planned measures for the improvement of the information infrastructure	Adoption of a High-tech Parks Act	Adoption of a High-tech Parks Act	Development of a Legislative and Institutional Framework
National Strategy for High-technology Development in the Republic of Bulgaria, December 1999 (not implemented)	The main impact area is the establishment of business relations between industry, science and education	Planned updating of programs, however there is no program yet	Research base renovation is the main area of impact	Improvement of the tax environment	Encouragement of venture capital. Development of technological incubators.	Establishment of organizational procedures and a coordinating body (not in place yet)
High-tech Activities and High-tech Parks Draft Bill (not implemented)	Industry, science and education are intrinsic elements of high-tech parks	Current updating of objectives and programs Participation of businesses and the non-governmental sector in the decision-making process	Specialized funds for research in high-tech parks	Improvement of the tax environment (VAT, corporate income tax). Opportunities for high-tech parks in free zones	Technological incubators are a mandatory prerequisite for high-tech parks. Specialized funds for starting-up high-tech companies	Statutory regulation of organizational procedures and a coordinating body
Legal Framework for Education and Science at the Ministry of Education and Science	Knowledge in Action Program; Contact persons under the 5th Framework Programme	Plans for development of priorities, strategies and programs. No evidence that their implementation has started	BAS Act, BAS Statutes, autonomy of establishments of higher learning	Ideas of adopting a bill on the encouragement of R&D - no public debate and no available information	Knowledge in Action Program	Two coordinating bodies. Plans for development of priorities, strategies and programs No evidence that their implementation has started
National Strategy for Encouragement of Small and Medium-sized Enterprises						
Working Program for the Implementation of the National Strategy for Encouragement of Small and Medium-sized Enterprises					Priorities for technology SMEs.	
Small and Medium-sized Enterprises Act						
National Regional Development Plan 2000-2006 National Economic Development Plan 2000-2006						

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